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Digitization of the archive of plates of the Asiago Observatory and of the Specola Vaticana

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Abstract. A great amount of highly valuable information is stored in the photographic archive of plates of many Observatories, and in particular in those of Asiago and of the Specola Vaticana. A proper digitization of these real treasury is therefore of paramount importance, both for the preservation of a volatile support and for the fuller exploitation of the scientific content. Here we present some of the results obtained so far (from August 2001 to March 2002), both for large format images of the Schmidt telescope and for spectroscopic plates.

Key words. astronomical data bases: miscellaneous

The photographic plate is a fragile and perishable support implying the risk, in time, to lose its entire information. It is urgent therefore to provide the means for an *adequate conservation* of this material and for its repair where necessary. Indeed, a preliminary examination of a random sample of plates has revealed areas where *the emulsion is detaching from its glass support*, with consequent loss of part of the image data. Therefore, a first intervention is being performed of visual inspection of the archives, to quantify the amount of damaged plates. The advice of experts will be sought in order to find ways to stop the deterioration of the emulsion, and if possible to restore its integrity.

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A feasibility study has started to assess the implications of the digitization and its techniques by using funds provided by the University of Padova. Two good quality scanners have been bought by the Department of Astronomy, one for the Asiago station and one for Padova:

- scanner Epson 1640 XL, A3 format, optical resolution 1600 × 3200 dpi, in Padova;
- scanner UMAX Powerlook 1100, A4 format, optical resolution 1200 × 2400 dpi, in Asiago.

After an initial period of testing, we have decided to provide for Asiago an Epson scanner identical to the one in Padova to guarantee uniformity of results. What's more, the same model of scanner is used by DLR in Berlin, an Institute with which we have underway a fruitful exchange of experiences (in particular for the

ADAS survey of asteroids[1]). Dr. S. Mottola of DLR has therefore installed in our computer stations a series of routine programs he wrote himself, that greatly enhance the ease of data acquisition, working in the Windows operating system and providing as output a *positive* FITS image that can be directly analyzed with IRAF.

Both scanners have been connected to identical dedicated PCs, with 1 GB of RAM, 40 GB of hard disk and DVD/CD writer. The size of the files deriving from the 20 × 20 cm S67/92 plates, scanned at 1600 × 1600 optical dpi, is around 280 MB and this poses a serious storing problem. We are for the moment saving the files to DVDs of 4.3 GB each, but this can only work as a backup, a dedicated system being necessary for the future. Since August 2001, several plates were digitized mostly by F. Rampazzi in Asiago and J. Civale in Padova, experimenting with the scanners' optical parameters.

To evaluate the photometric capability of the output digital files we have examined the Selected Area 57 using for comparison the photometric data given by Purgathofer (1969).

These preliminary calculations have been performed on scans obtained with the Umax scanner in Asiago. We have taken several images of the SA57 at 14 bit and 1200 dpi, from plates nr. 2329 and 2348, varying the parameters for *lights, shades and midtones*. Since every plate has its own intensity, there are no fixed parameters to use: a choice has to be made each time for best results. Checking star profiles and saturation we found that a good solution is to keep zero value for shades, to regulate lights so that the background is visible but not too noisy, and to choose a midtone value so that the faintest stars are still clearly perceptible while brighter ones are not saturated (the brightest stars will be saturated anyway).

The digital files have been analyzed with the IRAF-DAOPHOT package, adjusting some of the parameters to the photographic plate and to the scale of our Schmidt telescope. IRAF provides also an evaluation of the internal error, that raises from few hundredths of mag for the brighter stars to around 0.1 mag for the faintest objects. We have also checked the precision in the coordinates on the digital files. A comparison of two plates scanned with the UMAX (1200 dpi) in two successive dates provide the following results:

$$\Delta X = 0.00 \pm 0.43 \text{ px}, \ \Delta Y = 0.00 \pm 0.44 \text{ px}$$

corresponding to a standard deviation of about 0.9 arcsec, intrinsic to the scanner itself.

Then we have used the coordinates of the SA 57 stars provided by USNO-A2.0[2] (epoch 1955.287490) to check the equatorial coordinates. By a second order interpolation algorithm (Bertini 2001) the following standard deviation has been derived:

$$\sigma_{\mathrm{RA}} = 0.41 \text{ arcsec}, \ \sigma_{\mathrm{Dec}} = 0.62 \text{ arcsec}$$

. We have no explanation for the larger σ_{Dec}, more checks are needed to confirm the existence of this effect. We consider that these results are extremely encouraging.

We briefly sketch our plans for the rest of 2002:

- confirm with further tests the astrometric and photometric accuracy of the digitized plates;
- digitize some 1000 plates well distributed among the several telescopes;
- make those files (in .jpg format) accessible to the general user through the web for a quick view, and ask for comments;
- start a call for ideas in order to selectively digitize those plates that give a maximum scientific return.

References

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Purgathofer, A. 1969, Publ. Lowell Observatory, 7, 98

[1] `http://planet.pd.astro.it/adas/`

[2] `http://www.nofs.navy.mil/`